Regional variations of ice microphysical properties near the tops of deep convective cores implied by the GPM dual frequency radar observations

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Using three-year GPM dual frequency radar observations, precipitation systems are defined by grouping the contiguous pixels with surface precipitation detected by radar. Then radar reflectivity profiles are selected at the location with the tallest radar echo top in each individual precipitation systems. The properties of these profiles above 10 km are examined, focusing on the Dual Frequency Ratio (DFR) between Ku and Ka band radar reflectivity. DFRs near the top of continental convection are found larger than those over ocean in general. This implies larger ice particles in the convective cores over land. To validate this, simple ice particle size distribution retrieval lookup tables are created using simulations of reflectivity at Ka and Ku band with idealized gamma size distributions. Applying these lookup tables to the GPM observed reflectivity profiles, the properties of ice particle size distributions at the top of deep convective cores are derived. Then, the global geographical distribution of the mass median ice particles in the deep convection are constructed. Under a same and simple PSD assumption, larger ice particles are found near the top of deep convection over land than over ocean. The size of the ice particles increases in deep convection with stronger convective intensities indicated by higher echo top height of 30 dBZ. The distributions of number concentration of ice particles and ice water contents retrievals are also presented and discussed.

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